EFFECT OF FEEDING STATIONS ON THE HOME RANGES OF AMERICAN BLACK BEARS IN WESTERN WASHINGTON

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Abstract: Forest managers establish feeding stations throughout coniferous forests in western Washington that are vulnerable to American black bear (*Ursus americanus*) damage in the spring. This study was conducted to determine whether the home ranges of bears in areas with supplemental feeding were smaller than the home ranges of bears in similar adjacent areas without supplemental feeding. Home range sizes varied among bears. However, the home range sizes of bears in feeding areas did not differ ($P > 0.35$) from home ranges of bears in non-feeding areas. Male bears had larger ($P = 0.0002$) home ranges than female bears, but this difference was consistent across both treatments ($P > 0.35$). Bear home ranges were reduced ($P = 0.029$) during the feeding period relative to the non-feeding period, but this reduction was not related to treatment ($P = 0.261$). Although the supplemental feeding program did not affect home range sizes, the telemetry study data, supported by data collected through video-monitoring of feeding sites, indicated that feeding stations may attract and concentrate bears at specific locations.

Black bears commonly forage on Douglas-fir (*Pseudotsuga menziesii*) trees during the spring (Ziegltrum and Nolte 1996). They strip the bark to feed on the newly forming vascular tissue, which may contain 4–5% carbohydrates (Kimball et al. 1998). These vascular tissues are primary staples in the diet of some bears (Noble 1993). Bears feed on the vascular tissue by removing the bark with their claws and scraping the sapwood from the heartwood with their incisors. Bears generally feed on the lower bole of trees in stands 15–30 years of age (Ziegltrum 1994). Any age tree, however, is vulnerable, and bears occasionally strip bark from the entire trunk of a tree. A single bear can peel bark from as many as 70 trees/day. Thus, if preventive measures are not implemented, damage within a stand can be extensive (Schmidt and Gourley 1992).

Damage inflicted through this behavior can be extremely detrimental to the health and economic value of a timber stand. Complete girdling is lethal to the tree, while partial girdling reduces growth rates and provides avenues for insect and disease infestations (Kanaskie et al. 1990). Economic loss is compounded because bears tend to select the most vigorous trees within the most productive stands or where stand improvements (e.g., thinning) have been implemented (Mason and Adams 1989, Kanaskie et al. 1990, Schmidt and Gourley 1992).

Historically, bear damage management to protect timber resources generally required lethal removal of bears. Control agents or professional hunters were hired to trap and hunt bears throughout the counties where damage was occurring (Poelker and Hartwell 1973). Private timber mangers began investigating alternative damage control techniques, particular non-lethal methods, during the mid-1980s. The first directed effort to provide bears an alternative food to reduce girdling of trees was attempted

during 1985 (Ziegltrum 1994). That year, approximately 2,250 kg of pellets were distributed through 10 feeders. During 1999, nearly 288,500 kg of pellets were offered through about 850 feeders across western Washington, with a few feeders in Oregon and California. Pellets fed to bears are produced under the direction of the Washington Forest Protection Association. These pellets contain fats, proteins, vitamins, and minerals to provide a balanced diet for bears, although the high sugar content is regarded by program managers as the most important ingredient to alleviate damage to trees (Ziegltrum 1994).

Overall, the supplemental feeding program appears to be an effective means to reduce bear damage in timber stands (Ziegltrum and Nolte 1997). Bears generally peel fewer trees once they begin eating pellets. Some anecdotal evidence, however, suggests that success of feeding programs declines as population densities increase. This suspected decline in the program's efficacy occurs because of increased competition among bears or because some bears, particularly females with cubs, stop using feeders to avoid antagonistic encounters with other bears.

The effect of the supplemental feeding program on bear behavior is largely unknown. Interest in long-term consequences has increased as the supplemental feeding program has grown and has become more widespread across western Washington. Questions asked by timber managers have led to a series of studies conducted by the National Wildlife Research Center's Olympia (Washington, USA) Field Station to assess the effects of supplemental feeding on the nutritional status and behavioral characteristics of black bears. This study was conducted to determine whether the home ranges of bears in areas with established supplemental feeding were smaller than the home ranges of bears in similar adjacent areas without a

supplemental feeding program.

STUDY AREA

The study area was approximately 80 km southwest of Olympia, Washington, between 123°37'–123°00'W longitude and 46°42'–47°02'N latitude. Elevation ranged from 30 m along the Chehalis River to 798 m on Larch Mountain. Bears on timber stands where the supplemental feeding program has been practiced for several years were used to identify home range size of supplemental-fed bears. Bears on nearby timber stands where the supplemental feeding program has not been practiced were used to identify home range size of non-fed bears. Supplemental feed areas were owned by the Weyerhauser Company, while the non-feeding areas were located on the Capitol State Forest and the Lower Chehalis State Forest.

METHODS

We used radiotelemetry to monitor bear locations. Adult bears were captured and collared during spring of 1998 and 1999. Bears captured near (<1 km) feeding stations were considered to be using the supplemental feed. Bears captured on nearby timber stands without feeding stations were monitored to assess home ranges of bears without access to supplemental feed. These stands had sustained recent bear damage and were similar in age and habitat characteristics to stands with supplemental feeders. Between mid-July and late October, 4 bears in supplemental feeding areas and 5 bears outside of supplemental feeding areas were monitored at least every other day to assess home range size outside the feeding period. Additional bears were incorporated into the study during the spring of 1999 for a total of 17 bears in supplemental feeding areas and 8 outside the supplemental sites. Locations of all bears were monitored every other day from 1 May to 30 June, when bears were actively feeding at stations. Home range sizes of bears outside the feeding period were determined by monitoring bear locations every other day from mid July until late September.

Bear locations were identified by triangulating telemetry points. Efforts to locate bears were repeated until all locations were within an 0.125 km² on a map. Timber roads throughout the study area enhanced our ability to locate bears. Usually, all telemetry points used to triangulate a bear's location were collected within 10 minutes of each other, and when the observer was within 1 km of the bear. Home range size for each bear was estimated by the minimum polygon method with a 5% reduction of the area (Kenward 1987). A similar number of locations were used to estimate home range size for each bear within and outside the feeding period.

A three-factor analysis of variance was used to compare home range size differences among bears. The factors were treatment (area with and without supplemental feed), gender (male and female), and period (during and outside the feeding period). Home range size was the dependent variable. All 2-way interactions and the 3-way interaction among factors were considered significant at $P = 0.05$.

RESULTS

Home range sizes varied among bears. However, the home range size of bears in feeding areas did not differ ($P > 0.35$) from that of bears in non-feeding areas (Table 1). Male bears had larger ($P = 0.0002$) home ranges than female bears, but this difference was consistent across both treatments ($P > 0.35$). Bear home ranges were reduced ($P = 0.029$) during the feeding period relative to the non-feeding period (Table 1), but again this difference did not interact with treatment ($P = 0.262$), nor was there an interaction between period and gender ($P = 0.112$). The 3-way interaction among treatments, periods, and gender was not significant ($P = 0.098$).

Table 1. Mean sizes (km²) and statistical comparisons of home ranges for male and female black bears from areas with and without supplemental feeding in western Washington, 1998–99.

		n	Home range (km²)	S.E.	P values
Treatment	feed	17	11.3	2.4	> 0.35
	no-feed	8	13.9	3.8	
Gender	male	9	21.4	3.7	0.0002
	female	16	7.0	1.1	
Period	feeding	16	8.6	1.5	0.0286
	no feeding	9	18.5	4.3	

DISCUSSION

These data suggest that the supplemental feeding program did not significantly affect the home range size of black bears in western Washington. Bear home ranges were similar regardless of their proximity to supplemental feed. The finding that males had larger home ranges than females is consistent with other studies (Amstrup and Beecham 1976, Lindzey 1977, Young and Ruff 1982, Koch 1983).

Home ranges were not as large during the feeding period (1 May–30 Jun) as they were after the supplemental feeding program was halted. However, this response was similar on areas with and without feeders, suggesting that bears were not merely remaining close to feeders. Expanding home ranges coincided with the ripening of the berry crop. For example, one male covered more than twice the area during the first few weeks of June, when salmonberry (*Rubus spectabilis*) was ripe, that he had pre-

viously. This particular bear moved to an adjoining area to feed on ripening berries and returned only once to a feeder during the last 2 weeks that supplemental feed was available.

Although the supplemental feeding program did not affect home range sizes, there were indications that some bears altered their travel patterns to use feeding stations. In one case, a female swam a river and traveled several kilometers to frequent a feeding station every 3 or 4 days. After a brief feeding bout, she returned to her original location and confined herself to a relatively small area.

The study did not include a sufficient number of females with young cubs to confidently state the effect of feeding stations on their behavior. Only 2 females with newborn cubs were included in the telemetry study. These females, however, did not avoid areas with feeders. A female with triplets remained close (<0.5 km) to a feeder throughout the spring. Video monitoring of this feeder for another study showed this female visiting the feeder with her cubs toward the end of the feeding period (Nolte et al. 2001). The other female and her cubs were recorded at supplemental feeding stations throughout the feeding period.

The telemetry study data, supported by data collected through video-monitoring of feeding sites, indicated that feeding stations attracted and concentrated bears at specific locations. Numerous bears used the same feeders, and home ranges often overlapped at the feeding stations. Video recordings demonstrated that 18 bears used one feeding site during the study (Nolte, et al. 2001). Bears also were recorded using numerous feeding sites, often moving from one feeder to the next within a single day. These results suggest that potentially damaging bears are being encouraged to frequent specific locations most vulnerable to damage. This may be problematic if the feeding program is interrupted while trees within these areas remain most vulnerable to bear damage or if bear populations continue to increase. The supplemental feeding program generally becomes less effective as bear populations increase (Ziegltrum 1994), and high populations are likely to correspond to increased damage regardless of whether supplemental feed is available.

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